Potential Expansion of PCS Band to Include H Block

CTIA – The Wireless Association™

Ex Parte Meeting

ET Docket No. 00-258

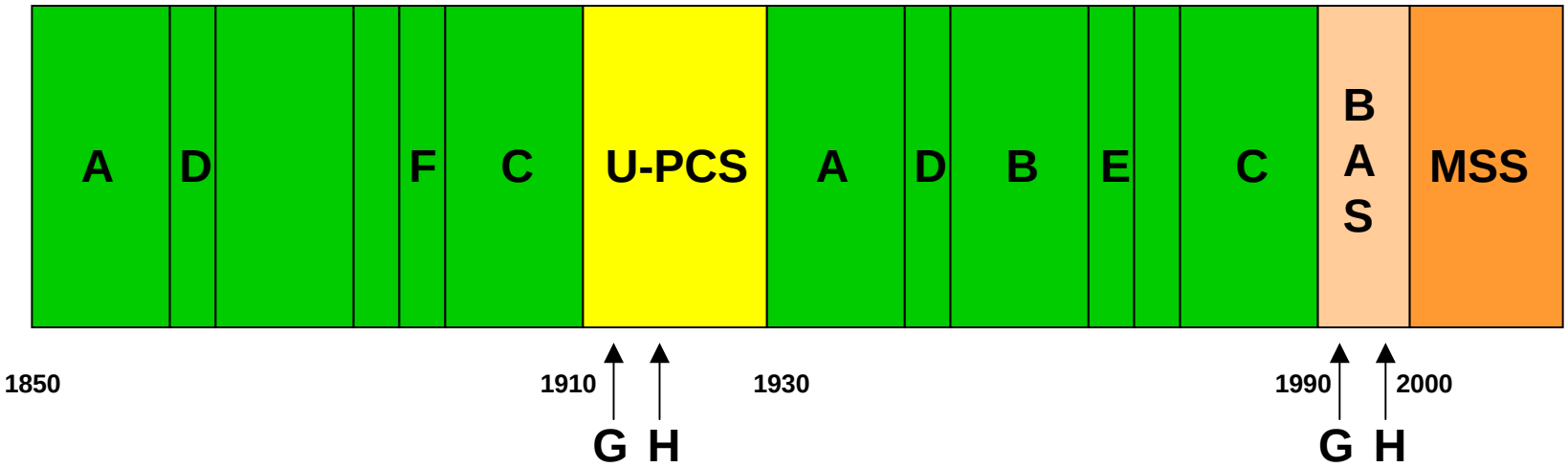
July 29, 2004

Outline

- Evolution of PCS Standards
- Out-of-Band Emissions (OOBE) Problem
- In-Band Problem
- Impact on Use of H Block
- Summary

Evolution of PCS Standards

PCS Band Plan

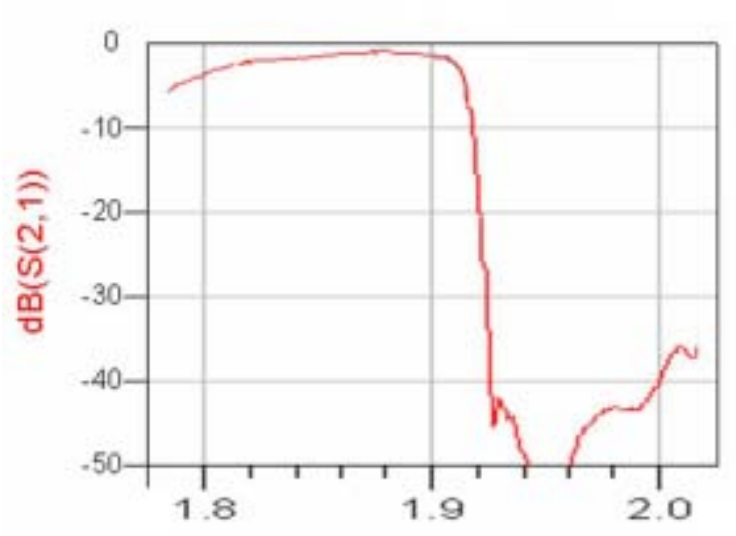


- Original PCS band plan designed to maximize spectral efficiency and minimize harmful interference.
- Close proximity of band segments provided technical challenges.
- Commission is considering adding G and H blocks, which stretches the limits of what is technically feasible.

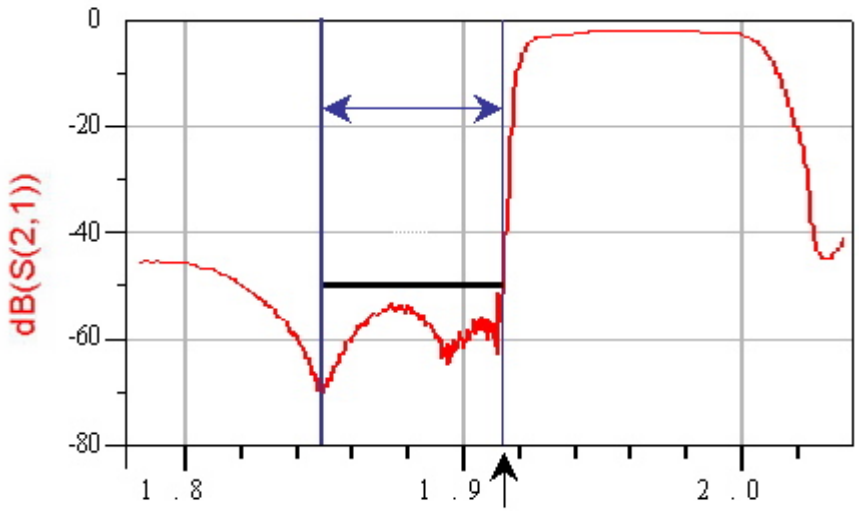
Evolution of PCS Standards

Design Parameters to Avoid Interference

Transmit Filter Characteristics



Receive Filter Characteristics



- Industry adopted stringent equipment design parameters to limit the emissions of PCS mobiles into the mobile receive band.
- Necessary to enable duplex operations and non-interfering operations of mobiles with 1 meter separations.

Evolution of PCS Standards

Out-of-band Emissions Requirements

FCC Rules		
	dBm/MHz	
Broadband PCS	-13	24.238
Cellular	-13	22.917(a)
700 MHz	-13	27.53(c)(1)
(mobile into PS band)	-13	27.53(c)(4)
(Glonass/GPS)	-40	27.53(e)
2.3 GHz (WCS)	-50	27.53(a)(1)
(mobile into SDARS)	-80	27.53(a)(2)
MSS ATC – 1995-2000 MHz	-40 → -13	25.252(c)(2)
MSS ATC – < 1995 MHz	-40	

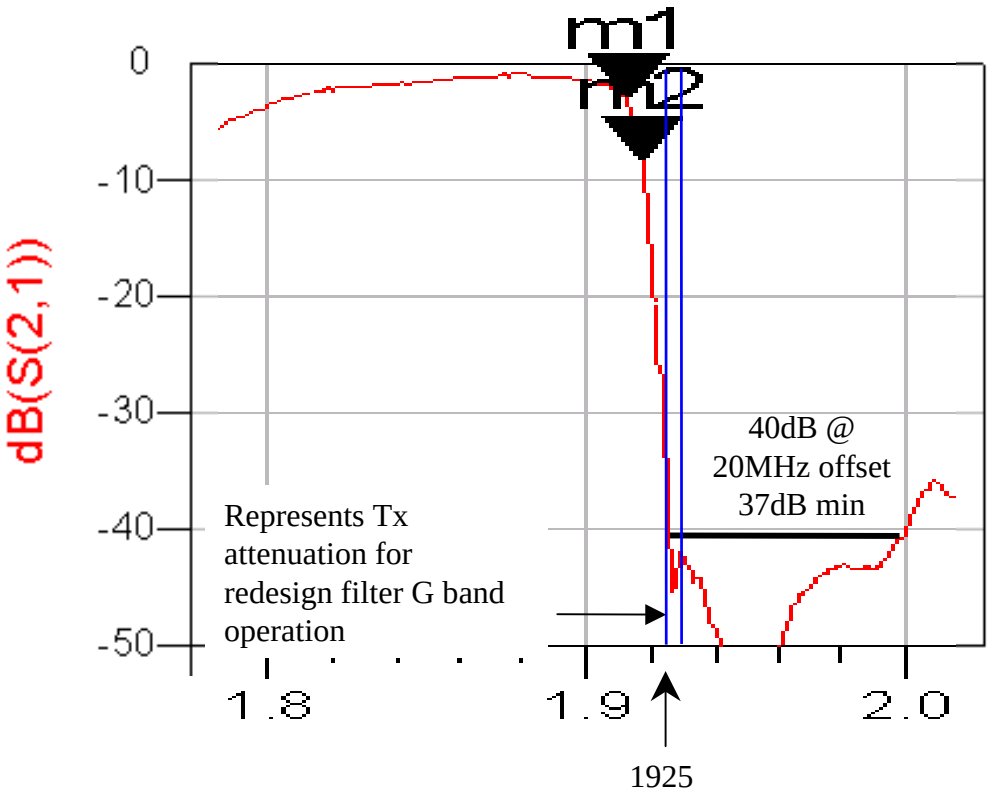
Industry Standards (into mobile receive band)		
	dBm/MHz	
GSM 400	-57	GSM 05.05
GSM 850	-69	GSM 05.05
GSM 900	-69	GSM 05.05
GSM 1900	-61	GSM 05.05
TDMA – 900 MHz	-65	ANSI 136-270
TDMA – 1900 MHz	-65	ANSI 136-270
CDMA – 800 MHz	-76	TIA/EIA-98-F
CDMA – 1900 MHz	-76	TIA/EIA-98-F

- Industry standards are significantly more stringent than FCC rules.
- All PCS equipment meets or exceeds industry standards.

OOBE Problem

Transmit Filter Considerations

- Transmit filter characteristics currently have 5 MHz tolerance to meet attenuation requirements
  - temperature compensation and manufacturing tolerances
- Filter attenuation of 3 dB for G band
  - Lose 3 dB in link margin
  - If compensated by higher Tx power, battery life reduced
- Filter attenuation of 8 dB for H band
  - Lose 8 dB in link margin
  - Cannot be compensated.
- **37 dB min attenuation at 1930 MHz can be attained for G band, but cannot be attained for H band.**



m1 = 1912.5 MHz
(G Block center freq)
dB(S(2,1) = -3.0021

m2 = 1917.5 MHz
(H Block center freq)
dB(S(2,1)) =-8.4160

OOBE Problem

What's Impact of Harmful Interference?

Total Cumul. Noise Floor Increase (dB)	Permitted I/N (dB)	Reduction in Coverage*	Additional Cells Required	Increase in Total Costs
0.33	-11	5%	5%	18%
0.5	-9	7%	8%	30%
1	-6	13%	18%	63%
3	0	35%	111%	390%

* Assumes "suburban" market (32 dB/dec)

Source: V-Comm, Comments to FCC, ET Docket No. 03-237, (Apr. 5, 2004)

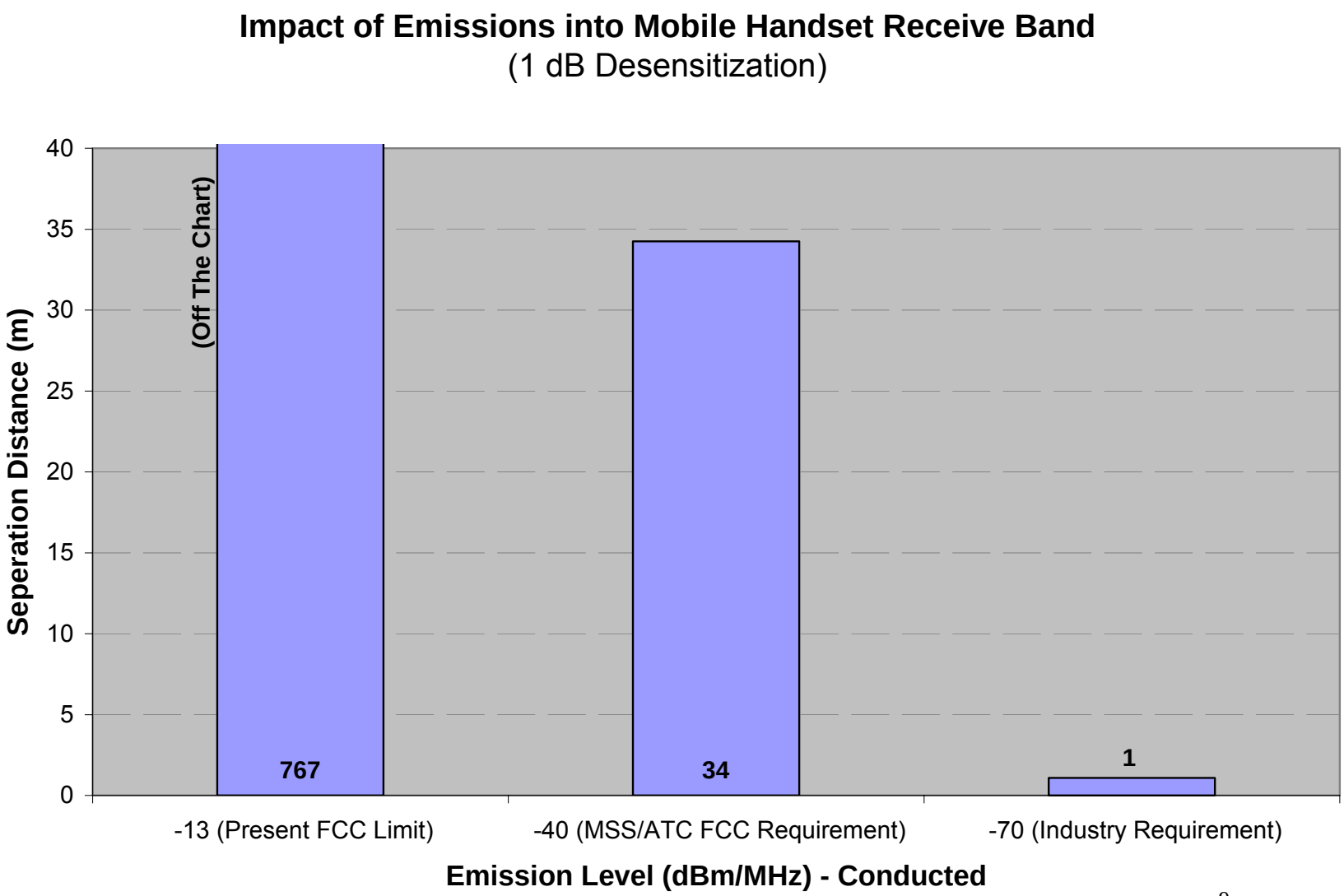
- Modern CMRS systems can compensate for increased noise resulting from excessive OOBE, but not without significant impact on coverage, capacity and/or total network cost.

OOBE Problem

Desensitization at 1930 MHz

Bandwidth of Handset in MHz	1.23	1.23	1.23	1.23
Noise figure of Handset Receiver in dB	5.00	5.00	5.00	5.00
OOBE of Transmitting Handset (dBm/MHz)	-13.00	-40.00	-70.00	-76.00
Antenna Gain of Transmitting Handset	-3.00	-3.00	-3.00	-3.00
Antenna Gain of Receiving Handset	-3.00	-3.00	-3.00	-3.00
Effective Noise Power in dBm/MHz	-19.00	-46.00	-76.00	-82.00
Frequency of OOBE interferer in MHz	1930.00	1930.00	1930.00	1930.00
KTB Rx Noise Floor dBm	-113.10	-113.10	-113.10	-113.10
Rx Noise Floor dBm	-108.10	-108.10	-108.10	-108.10
Attenuation required for 1/3 dB desensitization	100.97	73.97	43.97	37.97
Distance - 1/3 dB desensitization in meters	1379.10	61.60	1.95	0.98
Attenuation required for 1/2 dB desensitization	99.14	72.14	42.14	36.14
Distance - 1/2 dB desensitization in meters	1117.11	49.90	1.58	0.79
Attenuation required for 1 dB desensitization	95.87	68.87	38.87	32.87
Distance - 1 dB desensitization in meters	**766.6**	**34.2**	**1.1**	**0.5**
Attenuation required for 3 dB desensitization	90.00	63.00	33.00	27.00
Distance - 3 dB desensitization in meters	390.0	17.4	0.6	0.3

OOBE Problem

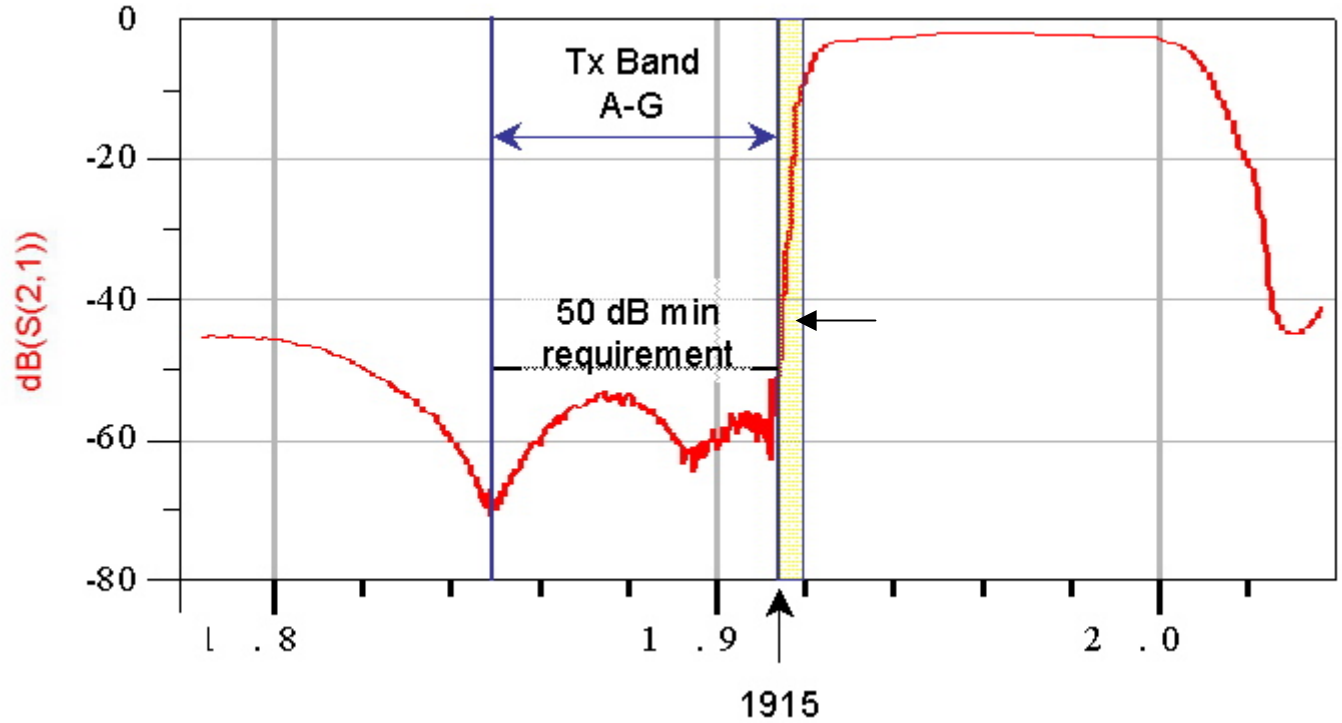


OOBE Problem

- G and H blocks have potential to produce harmful OOBE to existing PCS operations.
- G block can meet industry standards; H block cannot.
- H block handsets would have to meet -70 dBm/MHz OOBE limit to meet 1 meter design requirement.
- -70 dBm limit is based on 1dB degradation which results in substantial impact to CMRS networks.

In-Band Problem

Receive Filter Considerations



- Proximity of H block to mobile receive band prevents receive filter from effectively attenuating in-band signal.

In-Band Problem

- Existing PCS mobile receive filters cannot sufficiently attenuate in-band H block emissions.
- As a result, H block mobile transmitters can overload other PCS mobile receivers.
- Impacts all existing PCS mobiles.
- Nothing can be done to solve this in-band problem.

Impact on Use of H Block

- H block not feasible for broadband PCS because it can't meet industry equipment standards.
  - Requires large and expensive filters
  - Performance degradation
- H block would be subject to harmful interference from MSS/ATC operations in adjacent band.
  - No frequency separations
  - -13 dBm OOBE limit applicable to 1995-2000 MHz band

Summary of G & H Block Issues

- Addition of G block can be accommodated.
- H block cannot be used effectively for broadband PCS.
- Commission should not license 1915-1920 / 1995-2000 MHz band for services (e.g., mobile) that would cause harmful interference to existing PCS systems.
- Commission should consider use of the band for low-power unlicensed devices or licensed services that will not cause harmful interference to PCS.